

DoD Corrosion Prevention and Control

Environmental Issues in Corrosion Prevention

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Strategic Environmental R&D Program

- Joint efforts to develop new corrosion protection systems that are harmless to the environment.
- Joint investment in R&D focused on reducing or eliminating hazardous materials from DoD weapons systems and platforms by
 - The Strategic Environmental Research and Development Program (SERDP)
 - The Environmental Security Technology Certification Program (ESTCP)
- The major goal for these programs is the development of environmentally benign corrosion protection systems.
- The metrics are
 - the new systems must be environmentally benign or significantly less hazardous than the current systems.
 - the new systems must meet or exceed all of the corrosion protection performance specifications for current applications.
- There are two major focus areas:
 - alternatives to chromium and cadmium plating
 - alternatives to hexavalent chromium pretreatments, primers and topcoats.



Corrosion Prevention Technology

● Background

- For many years corrosion protection was successfully achieved using inhibitors such as Cr^{6+} that are now restricted or prohibited because of environmental concerns.
- Understanding of coatings and protective materials performance was based on experience within a narrow range of materials

● Impact

- Mechanisms of corrosion inhibition changed drastically as the available materials shifted.
- Hexavalent chrome in coatings may be replaced by sacrificial magnesium which functions via totally different mechanisms. Such differences create a completely new set of testing requirements, risks, and applications issues.

● Requirement

- Multiple new corrosion protection materials must be evaluated, and implemented. They must be tested, with new test methods developed, and performance mechanisms understood to prevent failures in actual service.



Hexavalent Chromium (Cr⁶⁺) Background

- Vital material in weapon systems and platforms due to corrosion protection properties
- Very toxic
- Many companies phasing out Cr⁶⁺
- Thousands of individual DoD applications
- Need practical approach to resolve trade-offs between DoD needs and environmental impact



Cr⁶⁺ Risk Management Options

- Cr⁶⁺ and other contaminants present a dilemma
 - Corrosion needs to be prevented or contained
 - Trade-off between environmental hazards and corrosion deterioration
- Risk management options focus on reducing risks while maintaining mission requirements
 - Minimize use of Cr⁶⁺
 - Develop improved testing
 - Identify barriers to introducing safer substitutes
 - Develop/share database of tests, specs, and lessons learned



Army Aviation and Missile Command Project

Alternative Chemical Paint Strippers

- SPOTA Funded, 250K
- Approximately 300K matching funds from OSD Corrosion Policy Oversight Office
- Program will be executed by CTC
- Objective is to evaluate a number of currently available HAP-free chemical paint strippers which will be tested in accordance with AED, AMRDEC, LEAD, and CCAD requirements
 - Test Plan development in work
 - Performance Testing
 - Materials Testing
 - Coupons being procured



Army Aviation and Missile Command Project

Hexavalent Chrome Free Coating for Missile Weapon System

- SPOTA Funded, 345K
- Objective of program is to demonstrate the following:
 - Evaluate missile primers with TCP on aluminum substrates
 - Alternative hexavalent chrome free pretreatment for wash primer compatible with mixed substrates (steel and aluminum)
 - MIL-PRF-23377 class N primers applied over zinc phosphate treated steel substrates
- Test plan nearing completion, Phase I coupons being prepared, equipment being procured



Army Aviation and Missile Command Project

Compatibility of Chrome Free Coating Systems with Tagnite Housings

- SPOTA Funded, 250K
- Objective of program is to evaluate the compatibility of chrome free coating systems with Tagnite coated housings
 - Evaluates the use of MIL-PRF-23377 Class N primer over Rockhard
 - Evaluates the use of hexavalent chrome free conversion coatings as a field repair technique
- Test plan is currently being generated, initial test coupons are being procured



Army Aviation and Missile Command Project

Alternative Strippers for Legacy Pretreatments

- EQT Funded, 200K
- Objective of program is to generate a test protocol to evaluate alternatives to hexavalent-chrome based surface finish stripping solutions
 - Program will also consider hexavalent-chrome containing surface activators used in surface finishing operations
- Testing requirements are currently being generated by AED materials



Other Projects Underway or Proposed to Replace Chromium and Cadmium

- W06AF01 – Magnesium Rich Primer for Chrome Free Aircraft Coating Systems
- W09NA03 – Pulse Water Jet Stripping of Chrome Plating and HVOF Coatings from Jet Engine Components
- W10NA02 – Amorphous alloys as hard chrome alternatives
- W10AR04 – Chromium Free Coatings for Missiles
- W10AR01 – Electroplated Aluminum Fasteners
- W10AR04 – HexChrome Free Coatings
- W10AR08 – "Green" Conducting Polymer Coating
- W10AR05 – Cadmium Alternatives for Fasteners and Bushings for Helicopters



Specific Steps for DoD Cr⁶⁺ Policy

- DoD policy on minimizing Cr⁶⁺ use completed
- DFAR contract clause underway
- Conduct study on alternatives – identify barriers
- Identify where Cr⁶⁺ substitutes have been proven for use
- Extend DoD Cr⁶⁺ database into full knowledge base



CPO Way Forward

- WIPT Approach
 - Establish a Cr ⁶⁺ usage certification process
 - Communicate state-of-the-art alternatives
 - Establish risk reduction process that accounts for performance/technical, environmental & logistics factors
- Establish a Cr ⁶⁺ elimination task force team
 - Develop action plan
 - Identify command use, applications, and current/future mitigation strategies
- Establish who will
 - Document, assess, monitor, track the use of Cr ⁶⁺
 - Program & budget for mitigation of environmental regulations

